High Speed 1541 Disk Operation

We can still recall our first experience with the 1541 disk drive. Actually it was a 1540 disk drive that we were running off a VIC 20 back in 1983. We had paid over $400 for it; in view of that princely sum, we were understandably disappointed when we found out that the 1540 was not completely compatible with the C-64 (but that's another story). It wasn't long after the luxury of not using cassette tapes wore off that we realized that the 1540/1 was not the speed demon we had hoped it would be. In fact when applied to the much larger programs of the C-64, the 1541 was downright tedious.

Nevertheless, those were still the days of wonder and the discovery of just what our machines could do. It wasn't long before we actually filled our first box of 10 disks (at $3 to $4 dollars per disk, no less) and started casting about for a usable disk copy program. Those early programs took from 30 to 40 minutes to back up an entire disk. The initial improvements consisted of a reduction in the number of disk swaps needed to copy a disk with a single drive from six to five and finally down to just three.

Conditions pretty well stabilized for about a year until a young man in Germany discovered a high speed serial bus technique and the era of three minute copiers was upon us. These were shortly followed by a variety of fast loaders, some in cartridge form and others on disk. Software publishers latched on to the idea, and very soon most games had a built-in fast loader of some kind. In the end even Commodore saw the light and pretty much corrected the problem with the C-128 and the 1571 disk drive.

While all these fixes addressed many aspects of the problem, they still did not resolve the basic issue. The 1541's serial bus is essentially slow. Although fast loaders did alleviate the tedium for some applications, most "serious" users of the C-64 obtained very little benefit. Operations involving data files for word processors, spreadsheets and databases were still slow. In particular the saving or writing of data remained a time-consuming process.

This month we examine four products which accelerate disk drive performance, three of which attack the problem of the serial bus directly. They do this using the most direct method possible, entirely bypassing the serial bus. If you can handle the required hardware hack, one of these products may be the best investment you can make for your C-64 and 1541.
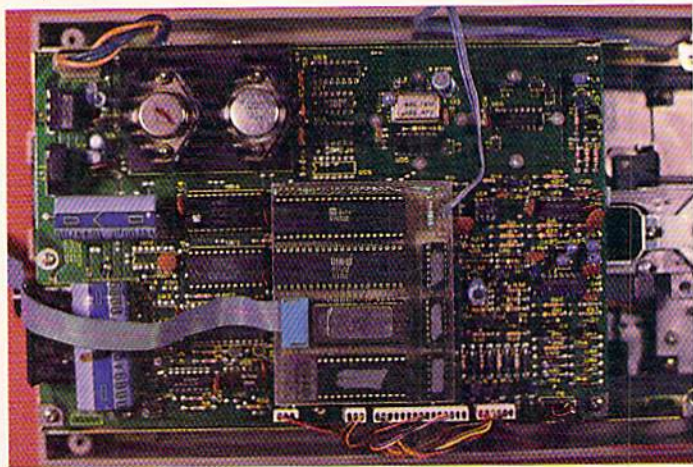
DOLPHIN DOS
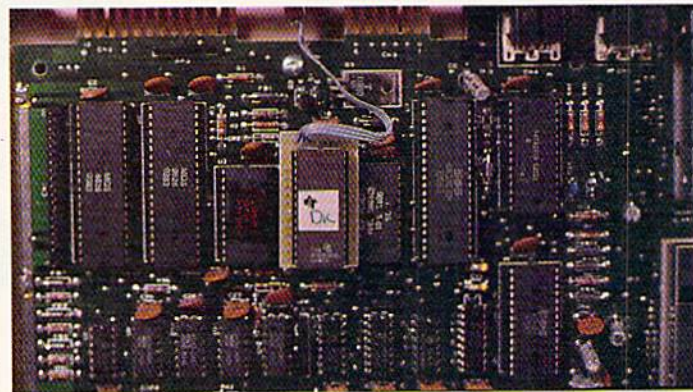### Micro Accessories of S. A.
Commodore 64 and 128

We first encountered *Dolphin DOS* at the Summer 1987 MARCA convention. At that time Mark Grove of Grapevine Data Products was doing some pretty impressive things with a C-64 and a 1541 which had *Dolphin DOS* installed. In the course of a few minutes we watched Mr. Grove load and run a selection of C-64 programs at seemingly instantaneous speeds. As it turned out the load times were not instantaneous; however, we were able to count the seconds they took on the fingers of one hand. This was with programs which we knew would take much longer to load under normal circumstances.

We subsequently found out that *Dolphin DOS* came from that land down below, South Australia to be precise, and that it was not available in the U.S. at that time. Since Micro Accessories of S.A. has expressed an interest in the U.S. market, we have decided to present a review of this product. We feel that the encouragement of development along these lines will benefit the Com-

TOP: Dolphin DOS shown installed in the 1541. The 6502 microprocessor and 6522 VIA are from your drive; the additional RAM is at the bottom with the ROM directly above it.

BOTTOM: Dolphin DOS replacement Kernal with its control switch as installed in the C-64.
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modore community. Unfortunately, the distribution details for *Dolphin DOS* were still not available as we went to press.

Dolphin DOS is a combination of hardware and firmware which equips a C-64 and a 1541 disk drive with a full 8 bit, high speed parallel interface. When *Dolphin DOS* is installed it endows the computer and disk drive with the ability to load 100 block program files in under three seconds. The save time for this size file clocks in at under seven seconds. These figures represent speed improvements, as compared to the unadorned hardware, of 20 and 10 times respectively. The reading and writing of sequential files is improved by a factor of 10 times. The manipulation of relative files shows the least benefit, with an improvement of only a factor of three. In exchange the C-64 loses the ability to access the cassette recorder, which we feel is a reasonable compromise.

In addition to the raw speed enhancement, *Dolphin DOS* provides some improvements to the operating environment. To start with, the LOAD command defaults to the disk drive as device number 8. Access to the disk commands is simplified by a full-featured DOS wedge. The disk drive's command repertoire is extended to include the

Control Key Commands

CTRL B	Cursor to bottom of screen
CTRL G	Cursor 20 columns right
CTRL L	Delete to left of cursor
CTRL K	Delete to right of cursor
CTRL @	Drive status
CTRL D	Display directory
CTRL A	Key repeat toggle
CTRL *	Copy screen to printer
CTRL V	Reset video display
CTRL X	Disable function keys
CTRL &	Enable function keys
CTRL DEL	Copy text to buffer and delete from screen
C=DEL	Retrieve text from buffer

locking and unlocking of files, thereby protecting them from inadvertent erasure. In addition the disk drive itself acquires the option to read and write out to track 40. This increases the disk storage capacity by 85 blocks or 21 kilobytes. As an added bonus, the alleged save with replace bug has supposedly been fixed.

The function keys take on new meaning with *Dolphin DOS*, 12 meanings to be exact. The extra four meanings are accessed by pressing the Commodore key along with a function key. The function keys issue frequently used commands which involve the disk drive, displaying the directory without

TOP: RapiDOS components in the 1541. Clockwise from top left: circuit board with new 6522 VIA, cable to user port, main circuit board. BOTTOM: In the 64: Kernal ROM on left, user port adapter with control switch to right.
READER SERVICE NO. 232

affecting the contents of memory, loading, running, saving and listing programs to both the screen and the printer, and quick access to the built-in memory monitor and its associated data scroll functions.

Operation of the full screen editor has been enhanced with the inclusion of control key commands. These are listed in the table at left. Note the use of the Commodore key for the last command.

As mentioned above, *Dolphin DOS* is provided with a built-in memory monitor. This is minimal monitor implementation, as it lacks the ability to assemble or disassemble 6502 code. The monitor does provide the capability of displaying and modifying the contents of memory in either hex or ASCII. Instead of scrolling the screen in the usual manner, blocks of data may be paged forward or backward.

If the computer is fitted with a reset button, then a RESET/SPACE will autostart a program in the $8000 block. BASIC programs can be retained in memory with a RESET/RUN STOP combination. A RESET/1 will fill memory with zeroes, while a RESET/CTRL jumps into the monitor.

The manual also indicates that a Centronics printer connected to the user port is directly supported as device number 4. We did not verify this, as the *Dolphin DOS* user port connector is not provided with a pass through, although one is supposedly available.

With regard to compatibility with commercial software, *Dolphin DOS* performed very well. Most of the programs we tried worked without any problems. If compatibility problems do occur, then *Dolphin DOS* may be manually disconnected in stages as required. The built-in soft switches can be used to cut out the fast load, deselect the extra RAM in the disk drive, and deselect the parallel bus. As a last resort you can electrically switch off *Dolphin DOS* entirely via separate toggle switches on the computer and the disk drive.

Dolphin DOS requires installation in both the disk drive and the computer. The disk drive hardware can be installed only on the short board version of the 1541 disk drive. If you have one of the original long board versions of the 1541, or a 1541C, then *Dolphin DOS* is not for you. To start with, you open
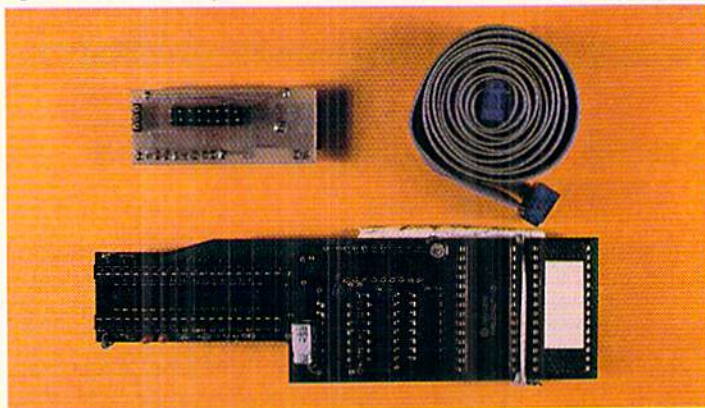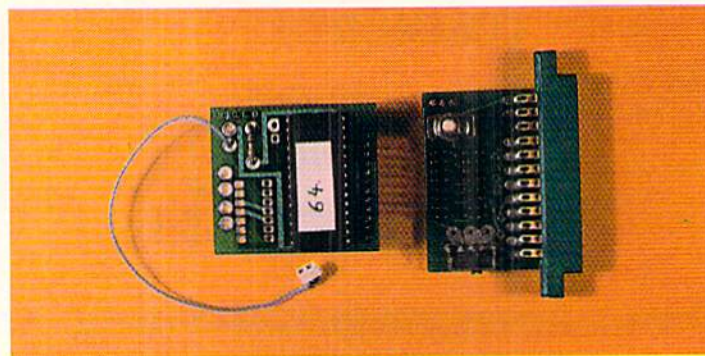
up your disk drive and remove the internal radio frequency shield. This should be put aside, as it will not fit once *Dolphin DOS* is installed. The 6502 microprocessor and the adjacent 6522 VIA chips are removed and the *Dolphin DOS* circuit board is installed in the empty sockets. The 6502 and the 6522 are then replaced on the *Dolphin DOS* circuit board.

The 1541 board contains 32 kilobytes of ROM and some additional RAM. We could not determine the exact quantity of add-on RAM, as the chip's identifying marks were removed. A multi-conductor ribbon cable is routed out the back of the disk drive to the computer's user port and a very small toggle switch is mounted on the front of the drive. The toggle switch is used to disable *Dolphin DOS* at the disk drive. We had to replace the toggle switch with one of our own, as the original did not survive the installation process.

At the C-64 you will have to remove the original kilobyte Kernal ROM and replace it with the 16 kilobyte ROM which is supplied with *Dolphin DOS*. This may present a problem for many users, as not all C-64's have socketed Kernal ROMs. Kernal ROM replacement may entail the unsoldering of the existing chip and the installation of a socket. The *Dolphin DOS* Kernal ROM actually contains a copy of the C-64's original ROM as well as the replacement Kernal. A miniature toggle switch lets you choose between the two.

Conclusion

Dolphin DOS provides a remarkable improvement in the performance of the 1541 disk drive. If you have the right hardware and you can handle the installation, then go for it. Unfortunately, the lack of the domestic distribution of *Dolphin DOS* may present a real problem. We had to make a trip to the airport just to get our sample through customs.

Micro Accessories of S.A., Unit 8 Hewittson Road, Elizabeth West, South Australia 5113 (phones: 08-287-0191, 08-252-0881). —*Morton Kevelson*

RAPIDOS
Chip Level Designs
Commodore 64
1541 version $49.95; 1541C $59.95

If you've been looking for an alternative to the sloooow operation of the

1541 disk drive, take a close look at *RapiDOS*. This is a hardware/firmware modification to the C-64 and 1541 drive that will make your system zip along at speeds you never thought possible. I know what you're thinking: "Another speed-up system—I'll have to resave all my files in this new format!" You won't have to do that with *RapiDOS*. Unlike the Epyx *Vorpal* system, or *DigiDOS*, this new offering reads and writes in standard Commodore format. It reads practically all that expensive software sitting on your shelves, including all your BASIC programs. And in cases where the software doesn't already have its own fastboot or fastload routines built in, *RapiDOS* will make those programs screech from the disk to RAM. Most of the disk operations required by the software will be executed faster, too. And, you'll get some improvements added to the computer.

Included are three IC chips: one Kernal ROM for the computer and a Kernal ROM and new VIA chip for the drive, as well as a parallel cable and an interface board for the user port of the CPU. The interface board contains a reset button as well as a switch to disable *RapiDOS*. If you're lucky, the CPU Kernal will already be socketed and you can just unplug the old Kernal and plug in the new one. If you're not lucky, you'll need to find someone experienced at soldering to make this change for you. Be forewarned that this modification will void your warranty if it's still in force. As for the drive, both the Kernal ROM and the VIA chip are socketed (except for the 1541C), making this phase of the installation fairly simple. Follow the instructions very carefully and seat the chips properly, lest you bend the leads and make trouble for yourself.

I received a preliminary manual with my *RapiDOS*, but it was very clear and concise. There were step by step instructions and plenty of sketches of all three possible drive models to avoid confusion. These sketches included views of the boards before and after installing *RapiDOS*. I could find no fault with the installation instructions that the manufacturer hadn't already corrected by the time I spoke with him.

The major improvements in the CPU include a DOS wedge, eight predefined function keys (LOAD, SAVE, a DIRECTORY key, LIST, RUN, a key for

switching between drives 8 and 9, and a key to disable the function keys), and an IRQ ML monitor. The key definitions were wisely selected. As for the monitor, it displays a screen full of hex as well as the corresponding ASCII characters, and allows for very fast scanning through memory in several directions. While the monitor's command set is quite limited (LOAD, SAVE, CHANGE MEMORY, CONVERT HEX/DECIMAL, ACCESS WEDGE, JUMP TO ML ROUTINE, and EXIT), it is a worthy addition. Other CPU features include options to freeze the screen scrolling, clear to end of line and end of screen, grab a logical screen line and print it elsewhere on screen, switch uppercase to and from lowercase, escape quote/insert mode, and move cursor to bottom left corner of screen. There is a lo-res screen dump (in text mode) always available, and the ability to POKE, PRINT, and calculate in hex, octal, and binary, and do conversions between these three number systems too. The results of the calculations, if printed, are always in decimal, but you would need to upgrade to *RapiDOS Professional* (see following review) to get decimal to hex conversions. Device 8 becomes the default device (no more typing ,8 all the time) and devices 1 and 2 are illegal. Also, the STOP key is much more responsive in aborting a load.

Loads can take many formats: relocating, non-relocating, fast, slow but use parallel lines, first file on disk, and don't change "end of BASIC" pointers. Device 4 is the default device for the OPEN command, and the system will look for a parallel printer first. All keys repeat on the faster RAM power-up, cursor speed is increased by about 25%, fast loads show start and end addresses, and there is an improved AND function algorithm. All these features make *RapiDOS* a fine improvement to the C-64, but the best is yet to come.

As advertised, *RapiDOS* loads BASIC and ML programs at tremendous speeds. 202 block files will load in 15 seconds, compared to 2 minutes and 12 seconds via the serial bus. 59 block files will load in 5 seconds, compared to 38 seconds via the serial bus. File handling from within programs is faster too, although the actual speed is dependent on the logic of the control-

ling program. I tried a 59 block *Speed-script* file (prg file) and got it loaded in 7 seconds instead of 41 seconds. An *Easy Script* file (seq file) of the same size loaded in 15 seconds instead of 43 seconds.

The key to maximizing the speed of *RapiDOS* is that the files must be written in standard Commodore 1541 format, meaning that the interleaving of blocks is critical. Some file copying programs copy files in 1541 format, but the interleaving is different, so *RapiDOS* takes a little longer to load these files (20 seconds for 202 blocks). Files written on the 1571 drive do not use the same interleaving as the 1541, even though a 1541 can read files written on a 1571. Just remember that if the file was *saved* on a 1541, then *RapiDOS* will be most effective. Other drive enhancements include faster head movement and drastically reduced head banging, as well as a 24 second format with full data verification. There is even a "scratch-protect" command that will toggle this flag on a file, thereby eliminating the accidental scratching of a file.

RapiDOS is a complete, professionally developed addition to the C-64/1541 system that any serious user should consider. Compatibility is very high and when there is a problem, returning to the standard C-64/1541 setup is only a reset button away. There is even a measure of compatibility with the 1764 RAM Expander. If you have a second drive (without *RapiDOS*), all the CPU features are still available, including the wedge and function keys.

Chip Level Designs, P.O. Box 603, Astoria, OR 97103-0603 (phone: 503-861-1622). —*Donald Graham*

RAPIDOS PROFESSIONAL
Chip Level Designs
Commodore 64 with 1541
Price: $99.95

If we piqued your interest with *Rapi-DOS*, and if you want to squeeze the maximum possible performance out of your 1541, you may just be ready for *RapiDOS Professional*. *RapiDOS Professional* has the same operating features as *RapiDOS* with a few extras thrown in. The most notable addition is the ability to format the disk out to 40 tracks, which adds 85 blocks of storage space. This feature can even be applied to disks which have previously been formatted and already have data on them without losing any of the existing information. If your disk is completely full it will no longer need to be so with *RapiDOS Professional*. Of course 1541s which do not have *Rapi-DOS Professional* will not be able to access the extra data.

The rest of the additional features are associated with the extra hardware provided with *RapiDOS Professional*. Soft switches let you turn off the extra RAM, the fast save, the write verify, and the full track buffering. These measures may be used to improve compatibility with some software. The disk drive's error channel report has been extended to indicate the status of the extra features. The preliminary manual failed to mention the ability to blank the screen while loading. The command which does the screen blanking is @DL+. The primary purpose of the screen blanking is to provide compatibility with PAL video systems and 50 Hz power supplies.

The bottom line is of course speed, and *RapiDOS Professional* comes through in this regard. A 204 block

program file loaded in just 4 seconds and saved in 10 seconds. A 100 block program file barely required 2 seconds to load. Our 50 block test file loaded so fast that it was difficult to get an accurate reading of the time it took. In *Easy Script* we were able to read in a 42 block text file in a bit over six seconds. A side effect of the high transfer speed and the extra RAM in the disk drive is that performance is not affected by the sector interleave.

RapiDOS Professional requires the installation of a substantial amount of hardware in the 1541 disk drive. Soldering should not be required, as all the affected chips will normally be socketed. As with *RapiDOS*, you start by removing the 1541's Kernal ROM and one of the 6522 VIA chips. A modified VIA chip on a custom mounting board is then installed and a parallel cable is hooked up and routed out the back of the drive over the power connector.

The VIA circuit board is a marvel of ingenuity. Some of the chip's pins remain in their default downward orientation and are inserted into the 1541's socket. The remaining pins are bent upward and are connected to an add-on circuit board which rests on the chip's back. A conservative designer might even consider the arrangement to be a real kludge. We look upon it as the product of creative thinking.

Unlike *RapiDOS*, the extracted disk drive Kernal ROM is not directly replaced. Instead the 6502 microprocessor is removed from its socket on the disk drive and a 5½" circuit board is installed in its place. The 6502 is then replaced in a socket on this add-on circuit board. The add-on board is fitted with 32 kilobytes of ROM which contains a copy of the original 1541 Kernal plus the *RapiDOS* operating system for the 1541. The board also adds eight kilobytes of RAM to the disk drive.

Installation of the circuit board in a short board version of the 1541 presented no problems. However, we ran into some difficulties with an original long board version of the drive. The circuit board failed to clear the shield cans of the disk drive's clock by a silly millimeter. We got around the problem by extending the 6502 socket by stacking two additional sockets in it. When the job was done the disk drive's cover

would not fit all the way down. The preliminary manual indicated that a similar modification is required for the 1541C. There are at least four varieties of the 1541 circuit board that we are now aware of. *RapiDOS Professional* should be able to fit in any one of these.

On the computer side you will have to remove the Kernal ROM and replace it with the *RapiDOS Professional* Kernal. This ROM contains a copy of the original C-64 Kernal as well as the *RapiDOS* operating system for the C-64. An adapter board is installed in the user port for the parallel connection to the disk drive. Connectors are provided for use with two disk drives. A miniature slide switch on the user port board disables *RapiDOS* in both the computer and the disk drive. The adapter board does not provide a pass through for the user port. If you wish to use a modem with *RapiDOS Professional*, simply pull out the user port board. This will automatically disable *RapiDOS*. A version of this ROM board is also available for the C-128 in C-64 mode.

RapiDOS Professional will automa-tically recognize a parallel printer, as device number four, connected to the user port. Data sent to this printer will be automatically translated from PETSCII or ASCII. Chip Level Designs can provide a cable which connects to the disk drive port, located on the user port board, for connection to the printer.

Conclusions

RapiDOS Professional is the most effective device for speeding up the 1541 disk drive which we have seen. This is fortunate, as it is the only device of its kind currently available in this country. Once again Chip Level Designs has demonstrated their expertise as applied to Commodore disk drive technology.

Chip Level Designs, P.O. Box 603, Astoria, OR 97103-0603 (phone: 503-861-1622).   —*Morton Kevelson*

C-128 BURST ROM
Chip Level Designs
Commodore 128
Price: $38.95

One of the many improvements of the C-128 computer and the 1571 disk
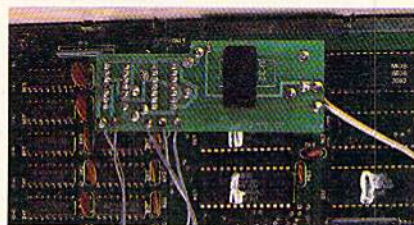
Burst-ROM *replaces the C-64 operating system in the C-128. Wires at right lead to control switch; leads at left terminate in C-128 micro-chips.*
READER SERVICE NO. 233

drive over the C-64 and 1541 is the increased data transfer speed between the two units. One of the benefits of the C-128 upgrade path is the total compatibility of new hardware with the existing base of C-64 software and peripherals. Unfortunately, the 128's C-64 emulation did not implement the new fast data transfer of the C-128 mode. Now thanks to Chip Level Designs, it is possible to have the best of both worlds.

In the C-128 there is a single 16 kilobyte ROM which contains the entire C-64 operating system. When the C-128 is powered up in C-64 mode, or

after the GO64 command is executed, the microprocessor executes only the code which is stored in this ROM. The *C-128 Burst-ROM* is a direct replacement for the C-64 mode ROM in the C-128. It is actually a 32 kilobyte ROM which contains a complete copy of the original C-64 ROM in addition to its own Burst-DOS operating system.

The installation of the *C-128 Burst-ROM* is a two step process. First the original C-64 mode ROM is removed and the *C-128 Burst-ROM* circuit board is installed in its place. This should not present a problem, since as far as we know all C-128's have socketed ROMs. However, if your C-128 does have its C-64 ROM soldered in place, skilled surgery will be required. Note that we referred to a replacement circuit board as opposed to a simple ROM. This circuit board carries wires which hook up to other points in the C-128.

To gain access to the ROMs you will have to open up the C-128 and remove the metal radio frequency shield which covers the circuit board. This shield has a number of fingers or tabs which come down and contact the major chips. The installation instructions suggest that the shield be left out to avoid shorting out the *C-128 Burst-ROM's* circuit board. Since the metal fingers serve to remove heat from the major chips, we suggest that the shield be reinstalled with a piece of insulating tape over the *C-128 Burst-ROM*.

To complete the installation, there are five additional wires which have to be connected at various points in the C-128. Each of these wires is terminated in a miniature, spring-loaded test clip which readily grabs hold of a component lead. Two of these wires go to ferrite leads along the back of the board. The instructions suggest that you scrape the connection points before hooking up. We found out the hard way that this was more than a suggestion. The leads seemed to be covered with a factory coating which prevented electrical contact. If you have the necessary skills you may wish to solder the wires in place after testing out the installation. As a side benefit you will have a set of five test clips which can be used elsewhere.

The installation is completed by routing a pair of wires with a miniature slide switch through the cassette port. This switch lets you easily restore the original C-64 operating system whenever it is required. Simply flip the switch and press the C-128's reset button, and you're back in operation.

The presence of *C-128 Burst-ROM* is easily recognized by its gray on black screen colors and the display of starting and ending load addresses whenever a file is loaded in. You may also notice shorter waiting times associated with disk operations. For example, a 59 block program file loads in 6½ seconds with *C-128 Burst-ROM* as compared to 38 seconds without it. Other operations may be speeded up as well. We found a 42 block *Easy Script* file read in 12 seconds with *C-128 Burst-ROM* versus 29 seconds without it.

C-128 Burst-ROM does more than speed up disk operations and display load addresses. In exchange for the loss of the cassette routines, *C-128 Burst-ROM* provides a built-in DOS wedge and other operating enhancements. Disk commands are sent to the drive by simply preceding them with the traditional @ or > wedge characters. The directory may be read without affecting the contents of memory. Even files may be displayed on the screen by the use of the exclamation point as a DOS command, as in @!filename or >!filename. The left SHIFT key or the SHIFT LOCK key may be used to stop screen scrolling.

Additional keyboard enhancements, which involve the CONTROL key, are provided as per the following list:

CONTROL & left arrow: moves the cursor to the bottom left corner.

CONTROL & CLR/HOME: clears to end of screen.

CONTROL & INST/DEL: clears to end of line.

CONTROL & +: grabs rest of screen line into the cassette buffer.

CONTROL & −: reprints the grabbed screen line.

CONTROL & *: performs a text screen dump to serial device 4 or to a user port Centronics printer.

CONTROL & N: switch to upper/lower case.

CONTROL & =: switch to upper case/graphics.

The last two functions come in handy, as the old COMMODORE-SHIFT key combination now works too fast to be easily controlled. In addition, the RUN STOP key will also cancel quote mode. Entering a shifted minus char-

acter as a direct command will clear and fill memory with $2D. Entering a shifted plus character performs a reset to power up conditions (same as SYS 64738).

For convenience the function keys are programmed with eight commands by *C-128 Burst-ROM*. These let you perform a single keystroke LIST, RUN, or LOAD, display the directory, enter the monitor, disable all the extra features, SAVE, and toggle the active device between 8 and 9. Additional features include base number conversions between decimal, hexadecimal, octal, and binary. There is an improved RND function, all keys repeat, and a faster RAM test is performed on power up.

For machine language programmers there is a built-in memory monitor. This lets you examine and modify the contents of RAM, access the disk drive, and save and load files. The monitor does not include the ability to assemble or disassemble 6502 code. The monitor works in real time, showing the contents of RAM as they actually change.

Overall, *C-128 Burst-ROM* does what it is supposed to. It gives you direct access to the high speed hardware built into the 1571 and 1581 disk drives. Drives not equipped with burst capabilities, such as the 1541, are automatically recognized and may be chained with burst drives. As a bonus you get a full-featured DOS wedge, a functional memory monitor, and a number of other enhancements. If the combination of features and enhancements gets in the way, they can be easily disabled.

Chip Level Designs, P.O. Box 603, Astoria, OR 97103-0603 (phone: 503-861-1622). —*Morton Kevelson*